Specification

Cylinders of a Web-Fed Printing Press and Printing Unit

The invention relates to cylinders of a web-fed printing press in accordance with the preamble of claim 1 or 4, and a printing unit in accordance with the preamble of claim 13.

A setting arrangement for the lateral registration of printing plates is known from DE 197 57 895 C2, wherein beveled edges of the printing plates are held in a narrow slit of a forme cylinder and each one has a registration cutout, with which a registration pin, fastened on an axially displaceable insert strip assigned to the latter, can be respectively brought into engagement, wherein the end of each of the insert strips is provided with an adjustment device for an axial back-and-forth movement, and wherein this adjustment device is embodied in such a way that each insert strip is angled off in an L-shape at one of its ends, wherein the angled piece is fastened to the front end of the forme cylinder by means of a screw.

A plate cylinder with an adjustable lateral registration is known from EP 0 229 892 B1, wherein small register plates are axially displaceable in the cylinder groove by means of a lateral register adjustment device, wherein the lateral register adjustment device has rotatable spindles and an adjusting screw.

A device for the correctly registered alignment of a rubber blanket on a cylinder of a printing group is known from USP 4,707,902, wherein clamping devices, which are arranged in a groove and can be actuated by means of a

bracing spindle, can be axially displaced via a manually adjustable threaded ring or an adjustment screw.

A plate cylinder with an adjustable bracing rail is known from DE 42 10 897 C1, wherein the bracing rail, which is arranged in a groove of the plate cylinder, can be displaced in a plane via structural roller ring units fastened on the bottom of the groove. Axial displacement takes place by means of a pin, which engages the underside of the bracing rail and is connected with an eccentric device, wherein the eccentric device extends from the interior of the cylinder through the bottom of the groove and can be displaced by means of a gear driven by a motor.

A device for bracing a printing plate on a plate cylinder of a printing press is known from DE 41 40 022 C2, having clamping devices for the front edge of the plate and the rear edge of the plate in an axially extending groove of the cylinder, wherein the clamping device for the front edge of the plate can be adjusted in the axial direction of the cylinder by means of an adjustment device, wherein the adjustment device can be displaced by means of an electric drive motor housed in the cylinder, wherein an adjusting shaft of the drive motor projects perpendicularly from the interior of the cylinder into the groove, and a rotating movement of the adjusting shaft is converted into an axial adjusting movement.

A device for axially positioning a printing plate is known from EP 0 808 714 B1, wherein, in the course of mounting, the printing plate can be positioned with exact lateral registration by means of an electrical positioning drive while being moved toward a cylinder.

A device for the displacement of at least one registration element of a printing press is known from DE 101 36 422 A1, wherein in one embodiment piezo-actuators are provided for position adjustment, wherein the position change takes place in the circumferential direction.

A device for bracing/clamping of flexible plates with beveled suspension legs on a printing press cylinder is known from DE 199 24 788 A1, wherein a base body with bracing and/or clamping elements, which are movable in its interior space, is arranged in a cylinder groove.

A device for adapting the position of printing plates to the deformation of the paper to be imprinted is known from DE 195 16 368 A1, wherein the position of a punched-out place on a printing plate provided for a registration pin, which is used for the adjustment of the printing plates arranged on a forme cylinder of a printing press, is adapted to correspond to a lateral extension (fan out) to be expected in the course of the passage of the paper during a plurality of print positions of the printing press, which are arranged one behind the other.

The object of the invention is based on creating cylinders of a printing press and a printing unit which compensate the lateral extension (fan out) of the material to be imprinted.

In accordance with the invention, the object is attained by means of the characteristics of claims 1, 4 or 13.

The advantages to be gained by means of the invention consist in particular in that it is possible by means of a lateral displacement of a holding device arranged in the

groove, or of a base body, to align the position, as needed, of a dressing, which has been applied to a cylinder and is held by means of the holding device, in relation to a material to be imprinted, which is stretched laterally to the production direction, or in comparison with other print positions in the printing unit, for obtaining an improved indexing, as well as lateral registration, accuracy. This matching of the position can be performed by means of an electrical control signal which can be issued by remote control, for example from a control console, during the running production process, i.e. without it being necessary to stop the printing unit. The tracking of the print images which are to be brought into congruence can be expanded into an automatically acting control circuit, which relieves the operators, because otherwise the checking of the indexing, as well as the lateral registration accuracy is a task of the operators monitoring the printing process.

It is particularly effective that it is possible to arrange the means for displacing a holding device, or a base body, integrated into the groove, in particular in a groove extending underneath the surface area of the cylinder, wherein the groove only has a slit-shaped opening toward the surface area. The integration of the means for displacing a holding device, or a base body, in the groove allows them to be retrofitted to a cylinder already in operation, because no extensive intervention is required. By means of an appropriate shaping it is possible to fit the actuating means into the groove in an advantageous manner.

An exemplary embodiment of the invention is represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a material to be imprinted extending underneath a cylinder,

Fig. 2, a partially sectional representation of a cylinder with a groove and a holding device for a dressing arranged therein,

Fig. 3, a partially sectional representation of an actuator in a groove.

A cylinder 01 (Fig. 2) in a printing unit, for example a forme cylinder 01 or a transfer cylinder 01 in a rotary printing unit, preferably in a printing unit of a web-fed offset printing press for newspaper printing, can be occupied by at least one dressing 02, wherein a dressing 02 to be applied to a forme cylinder can be embodied as a preferably flexible plate-shaped printing forme 02, or a dressing 02 to be applied to a transfer cylinder 01 as a printing blanket applied to a transfer cylinder 01, wherein the dressing 02 has suspension legs 06, 07, which are beveled at its ends 03, 04, wherein the suspension legs 06, 07 can each be inserted into a slit-shaped opening 08 in the surface area 09 of the cylinder 01, which preferably extends axially in respect to the cylinder 01, and are preferably held by a holding device, wherein the holding device is located in a groove 11, wherein the groove 11 preferably extends axially in relation to the cylinder 01 underneath the surface area 09 of the forme cylinder 01 and is accessible through the opening 08. The

purpose of the holding device is, inter alia, to fix the dressing 02 applied to the surface area 09 of the cylinder 01 in place in the axial direction of the cylinder 01, which can be performed, for example, by a holding element 18, embodied as a registration pin, on the holding device.

Advantageously, the groove 11 can be embodied in the interior of the cylinder 01 at a distance a of, for example, 4 mm to 10 mm, preferably 5 mm, underneath its surface area 09 as a preferably circular bore, and can have a diameter D of, for example 25 mm to 50 mm, preferably 30 mm, wherein the ratio of the diameters of the cylinder 01 and the groove 11 preferably lies approximately at 10:1. If the cross-sectional surface of the groove 11 is not embodied to be circular, the ratio of the cross-sectional surfaces of the cylinder 01 and the groove 11 is at least 100:1, so that the cross-sectional surface of the groove 11 is always comparatively small compared to that of the cylinder 01.

Preferably at least the ends 03, 04 of the dressing 02 are made of a metallic material, for example an aluminum alloy. Customarily the thickness M of the material of the suspension legs 06, 07 beveled off at the ends 03, 04 of the dressing 02 is a few tenths of a millimeter and lies, for example, in the range between 0.2 mm and 0.4 mm, preferably 0.3 mm.

It is advantageous to suspend respectively one suspension leg 06, 07 of the dressing 02 in the cylinder 01 from a first wall 12 in a positively connected manner, wherein this first wall 12 extends from an edge 13 of the opening 08, which is leading in the production direction P of the cylinder 01, toward the interior of the groove 11. The

angle at one end 03 of the dressing 02 existing between the beveled suspension leg 06 and the dressing 02 stretched out flat preferably corresponds to the angle α which results between this first wall 12 extending toward the interior of the groove 11, and an imagined tangential line T resting on the opening 08. The other suspension leg 07 of the dressing 02 can also be placed against a second wall 16 in the cylinder 01, wherein this second wall 16 extends from an edge 17 of the opening 08, which is trailing in the production direction P of the cylinder 01, toward the interior of the groove 11. The angle at an end 04 of the dressing 02 existing between the beveled suspension leg 07 and the dressing 02 stretched out flat again advantageously corresponds to the angle ß which results between this second wall 16 extending toward the interior of the groove 11, and an imagined tangential line T resting on the opening 08. It is advantageous to make the angle α between 40° and 50°, preferably 45°, and the angle ß between 80° and 95°, preferably 90°. The suspension leg 07 placed against the wall 16 is preferably beveled at the same angle ß. A bevel of the suspension leg 07 between 80° and 85°, in particular 83°, is advantageous. The slit width W of the opening 08 is less than 5 mm and preferably lies in the range between 1 mm to 3 mm, so that the ratio of the diameter of the cylinder 01 and the slit width W preferably lies approximately at 100:1.

In accordance with a preferred embodiment variation, the holding device arranged in the groove 11 consists of at least one holding element 18, preferably a clamping piece 18, and a spring element 19, wherein a suspension leg 06 or 07 of the dressing 02 inserted into the opening 08 is preferably

placed against the second wall 16 extending from the opening 08 to the groove 11 and is pressed on there by the clamping piece 18 by means of a force F exerted by the spring element 19 on the clamping piece 18. A first actuating means 21 is provided in the groove 11 for releasing the clamping which, when actuated, counteracts the force F exerted by the spring element 19 on the clamping piece 18 and pivots the clamping piece 18 away from the second wall 16 of the opening 08. A hose 21 which can be charged with a pressure medium, for example compressed air, is preferably provided as the first actuating means 21 for actuating the holding device and is advantageously placed to extend continuously in the groove 11, so that all holding devices arranged in a groove 11 can be simultaneously actuated by the actuating means 21.

For easier mounting in the groove 11, the holding device, together with its first actuating means 21, can be arranged in a base body 22, wherein this base body 22 can be advantageously designed essentially as a hollow body, whose exterior contour is essentially matched to the contour of the groove 11, wherein the base body 22 is preferably supported, fixed against relative rotation, in the groove 11, wherein the clamping piece 18 is seated in a pivot bearing 23 in the interior or on the bottom of this base body 22. It can be advantageous to embody the base bodies 22 as section pieces of a length l (Fig. 1) of, for example, 30 mm to 100 mm, preferably 60 mm, wherein the length l of an individual base body is short compared to the length L of the barrel of the cylinder 01, so that several, preferably identical base bodies 22 are arranged in a row in the groove 11 for holding the dressing 02, wherein the individual base bodies 22 can be

connected to each other by couplings formed on their front faces. For example, these couplings can consist of toothed connections, tongue-and-groove connections or pin connections

A material 24 to be imprinted in the printing unit is, for example, paper 24. Paper 24 is a three-dimensional, hygroscopic material, which changes its shape under the effects of temperature, humidity and mechanical pressure generated during the printing process by means of forces acting on the surface of the paper. Of particular interest here is a lateral extension Q of the paper, the so-called fan out, by which is meant a dimensional change of the material 24 to be imprinted, in this case the paper web 24 or the paper sheet 24, transversely to the production direction P of the cylinder 01.

The lateral extension Q of the material 24 to be imprinted leads to problems, in particular in a printing unit in which the material 24 to be imprinted is to be printed in more than one color. The printing unit can be embodied, for example, as a nine-cylinder satellite printing unit, in which four pairs of cylinders 01, each consisting of a forme cylinder 01 and a transfer cylinder 01, are arranged in a frame around a common counter-pressure cylinder, wherein each pair of cylinders 01 constitutes a print position and prints a definite color for the same printed image on the material 24 to be imprinted. Even with a printing unit embodied as a nine-cylinder satellite printing unit, in which four print positions responsible for the individual colors are arranged next to each other in a narrow space, the material 24 to be printed still travels a path of up to 1 m until all four colors for a common printed image have been applied to the

material 24 to be imprinted. With different designs of the printing unit, the path to be traveled by the material 24 to be imprinted from the printing of the first to the last color of the common printed image is even much longer, for example longer than 3 m. The dimensional change of the material 24 to be imprinted because of the lateral extension Q can be correspondingly greater and lasting. If, on its way from one print position to the next, the material 24 to be imprinted changes in its dimensions transversely to the production direction P of the cylinder 01, an inaccurate fit between color points which are to be printed next to or above each other and of which the printed image is composed results. If this so-called indexing is too inaccurate, because the indexing accuracy exceeds a definite tolerance of, for example, 50 μm, the human eye recognizes this inaccuracy and the quality of the printed image is judged to be bad. Moreover, it is necessary to arrange the printing formes required for different colors of the same printed image on their respective cylinder 01 in such a way, that the printing formes of all print positions are aligned with each other as exactly as possible for the common printed image during the printing process. This is called here the side and circumferential registration accuracy of the printing formes. In actuality, indexing, as well as side and circumferential registration, accuracy of 10 μm and less is often demanded nowadays. The dimensional instability of the material 24 to be imprinted, caused in particular by its hygroscopic behavior, makes it necessary to design the alignment of the respective dressings 02 placed on a cylinder 01, for example the printing formes 02, and in particular the printed images

made by them, to be adaptable to each other during the ongoing printing process.

It is proposed to provide at least one second actuating means 26, which is controllable from outside the print position, or the printing unit, preferably an actuator 26, which displaces a holding device displaceably arranged in a groove 11, by means of which a dressing 02 is held on a cylinder 01, at least in the axial direction of the cylinder 01. The actuator 26 can be designed as a piezo-electric system or a magnetostrictive system, which is arranged in a housing with a head element 27 and a base element 28 and has been inserted into the groove 11, wherein at least the base element 28 of the housing is rigidly connected with the groove 11, wherein an applied electrical control signal US causes the head element 27 to make a translatory movement over a defined actuating path s, while the base element 28 remains stationary. In this case the actuating path s of an actuator 26 can lie in the range of approximately 100 μm. However, displacements up to a total of 2 mm can be necessary.

The actuating means 26, or the actuator 26, preferably perform a translatory movement for displacing the holding device, or the base body 22, arranged in the groove 11. An actuator 26 embodied as a piezo-electric system utilizes the so-called indirect piezo effect, and essentially has a piezo-electrical body made of a crystalline, ferro-electric material, for example a quartz crystal, which is elastically deformed when charged with an electrical field. If the body is prevented from being deformed, a mechanical stress is created in the crystalline structure of the body, so that a

force is exerted on the device preventing the body from being deformed. As a rule, charging the piezo-electric body with an electric field takes place by applying an electric voltage to electrodes attached to the piezo-electric body. Analogously, a magnetostrictive system used as an actuator 26 also has a body made of a material with magnetic properties, which uses the physical effect of magnetostriction. Thus, this body can consist of a ferromagnetic metallic material, wherein this body is surrounded by a coil in order to charge the body with a magnetic field when an electric current is applied to the coil, which causes the body to become elastically deformed, wherein the deformation of the body can be used for a definite exertion of a force on a device connected with the body, if the body is firmly clamped on one side. The actuator 26 causes a displacement of the holding device, or of the base body 22, arranged in the groove 11, by its body being exited to perform a change in length or shape, wherein the length or shape change of the body is triggered by a control signal US applied to it. A different exemplary embodiment can provide a preferably electrically operable actuating means 26, for example an electric motor arranged in the groove 11, whose effective direction is axially aligned in respect to the groove 11.

The housing of the actuator 26 can be arranged in the groove 11, for example, in such a way in relation to a holding device, that the actuating path s caused by the head element 27 acts directly on the holding device, and the head element 27 displaces the holding device corresponding to the actuating path s in the groove 11. If the holding device is arranged in a base body 22 and is rigidly connected with the

base body 22, the actuating path s caused by the actuator 26 preferably acts on the base body 22 arranged in the groove 11. For making possible a simple matching of at least the head element 28 to the holding device to be displaced, or to the base body 22 to be displaced, it is advantageous to match the housing of the actuator 26 to the geometry of the groove 11 and, if necessary, to match at least the base element 28 to the groove 11 in the sense of a close fit. If the groove 11 is embodied as a circular bore, the cylindrical embodiment of the housing of the actuator 26 suggests itself. For causing as long as possible an actuating path s by means of an actuator utilizing the piezo effect or magnetostriction, it is advantageous to select a structural shape of the actuator 26 wherein the length l26 of the actuator 26, which extends in the same direction as the actuating path s, is to be clearly greater than the dimensions extending transversely thereto. Thus, the ratio of the length l26 to the width b26 of the actuator 26 is at least 2:1, in particular greater than 4:1, from which a longer, narrower structural shape of the actuator 26 results. The effective direction and, corresponding to it, the installed position of the actuator 26, is always selected to be directed in the same way as the intended displacement of the holding device, or of the base body 22.

To achieve a longer actuating path s than can be generated by a single actuator 26, it is also possible to connect two or more, preferably identical actuators 26 in series, wherein only the actuator 26, which is located the farthest from the holding device to be displaced, or from the base body 22 to be displaced, is rigidly connected with the

groove 11. With the remaining actuators 26, a base element 28 of the next following actuator 26 is rigidly connected with the head element 27 of the previous actuator 26, so that their actuating paths s can be added together when an electrical control signal US is simultaneously applied to several actuators 26.

By displacing the holding device, or the base body 22, in the groove 11 by means of a controllable actuating means 26, or actuator 26, it is possible to laterally displace a dressing 02, which has been applied to the cylinder 01 and is held in place by the holding device, by remote control, for example from a control console, while the printing process is running, i.e. without a printing unit needing to be stopped, because of which the position of the dressing 02, and therefore the printed image printed by it, can be aligned as needed in relation to the material 24 to be imprinted, which is stretched laterally in relation to the production direction P of the cylinder 01, or in relation to other print positions, for the purpose of obtaining an improved indexing, as well as side and circumferential registration. If in the course of passing through the printing unit the lateral extension Q of the material 24 to be imprinted changes from one print position to a further, subsequent print position, the actuating path s, which is provided by an actuating means 26, or actuator 26 arranged there in a cylinder 01, can be of different dimensions, for example can be longer from one print position to the next.

Several dressings 02, i.e. preferably two to six dressings 02, can also be arranged in the axial direction of the cylinder 01, so that the actuating means 26, or the

actuator 26, changes a distance between two, preferably adjoiningly arranged, dressings over an actuating path s, oriented axially in respect to the cylinder 01. It is advantageous if the at least one actuator 26 arranged in the groove 11, or the at least one actuating means 26 arranged in the groove 11, displaces the two dressings 02 affected by the distance change simultaneously and in the same way over an actuating path s oriented axially in respect to the cylinder 01. It can also be provided that at least one actuator 26, or at least one actuating means 26, in the groove 11 is assigned to each one of the dressings 02, which are arranged in the axial direction of the cylinder 01 on its surface area 09. If two grooves 11, which are arranged offset in respect to each other in the circumferential direction of the cylinder 01, are provided, at least one actuator 26, or at least one actuating means 26, can be arranged in each groove 11. At least one holding device, for example, is assigned to each dressing 02, which maintains the dressing 02 on the surface area 09, wherein the actuator 26, or the actuating means 26, changes a position of the holding device holding the dressing 02 in the axial direction of the cylinder 01.

It is furthermore advantageous to provide a linear measuring system designed as a DMS full bridge and to integrate it, for example, into the housing of the actuator 26 for determining the actuating path s provided by the head element 27, after which the measurement result is transmitted for evaluation to a location outside of the cylinder 01, for example to a control console of the printing unit. If the printed image, or reference markers, on the material to be imprinted are detected by means of a sensor directed onto the

material 24 to be imprinted for determining an intended position of a printed image which had been imprinted at different print positions, for example by means of an image sensor, in particular a CCD camera, it is possible to construct a regulating device, which corrects, as required, the actuating path s provided by the actuating means 26 to the holding device in the axial direction of this cylinder 01 by means of a comparison with the intended position of the printed image.

List of Reference Symbols

01	Cylinder, forme cylinder, transfer cylinder
02	Dressing, printing forme
03, 04	Ends of the dressing
05	-
06, 07	Suspension legs
08	Opening
09	Surface area
10	-
11	Groove
12	Wall, first
13	Edge, leading
14	-
15	-
16	Wall, second
17	Edge, trailing
18	Clamping piece, holding element
19	Spring element
20	-
21	(First) actuating means, hose
22	Base body
23	Pivot bearing
24	Material to be imprinted, paper, paper web, sheet of paper
25	-
26	Actuator, (second) actuating means
27	Head element
28	Base element

F	Force
D	Diameter
L	Length
M	Thickness of the material
P	Production direction
Q	Lateral extension
T	Tangent line
W	Slit width
US	Control signal
a	Distance
l	Length
l26	Length
b26	Width
s	Actuating path
α	Angle
ß	Angle